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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fifth Semester, B.E. - Civil Engineering

Semester End Examination; February / March - 2022

Design of RC Structural Elements

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Apply the knowledge of engineering fundamentals and understand different method of design and terms terminology in design methods.

CO2: Identify Analyse and Design using limit state methods for beam elements using relevant codes.

CO3: Identify Analyse and Design using limit state methods for Slab and stair elements using relevant codes.

CO4: Identify, Analyse and Design using limit state methods for column and Footing elements using relevant codes.

Note: ***I) PART - A*** *is compulsory.* ***Two*** *marks for each question.*

II) PART - B*: Answer any* ***One*** *sub questions (from a, b) for Maximum of* ***18 marks*** *from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
I a.	With Strain diagram, explain under reinforced sections.	2	L2	CO1	PO1
b.	Determine ultimate moment of resistance for T-beam with data given. Breadth of flange = 750 mm, depth of flange = 125 mm, area of steel = 4 bars of 20 mm diameter + 1 bars of 16 mm diameter. Consider M20 concrete and Fe 415 steel.	2	L2	CO2	PO2,3,4
c.	In what circumstances the doubly reinforced sections are preferred?	2	L1	CO1	PO2,3,4
d.	Differentiate between one-way slab and two-way slab.	2	L1	CO3	PO2,3,4
e.	Estimate the safe ultimate axial load bearing capacity of a circular column of 300 mm diameter. The column is reinforced with 10 bars of 20 mm diameter longitudinal bars. Use M25 concrete and Fe 415 steel.	2	L2	CO4	PO2,3,4
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	i) Obtain an expression for moment of resistance of singly reinforced rectangular section.	6	L2	CO2	PO2,3,4
	ii) A reinforced concrete beam of size 230 mm wide and 550 mm deep with an effective cover of 50 mm on tension side and 40 mm on compression side. The reinforcement consists of 5 bars of 20 mm diameter on tension side and 4 bars of 16 mm diameter on compression side. Calculate ultimate moment of resistance. Assume M20 concrete and Fe 415 steel.	12	L2	CO2	PO2,3,4
b.	i) With frequency distribution curves explain characteristics load and characteristic strength.	6	L2	CO1	PO1

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	ii) A reinforced concrete beam of effective cross section 300 mm and 500 mm consists of 3 bars of 16mm diameter on tension side. Determine the superimposed load the beam can carry over an effective span of 5 m. Use M20 concrete and Fe415 steel. The beam is simply supported.	12	L2	CO2	PO2,3,4
	UNIT - II	**18**			
2 a.	i) With a neat sketch, explain any two modes of shear failure of beam.	4	L2	CO2	PO2,3,4
	ii) Design the vertical shear reinforcement for a simply supported beam carries a uniformly distributed load of 70 kN/m. The steel at the tension side of the section consist of 4 bars of 25mm diameter which are continued to support. Assume M20 concrete and Fe415 steel. Consider the effective length = 5 m, width of beam = 300 mm and overall depth of beam = 500 mm. Adopt effective cover = 50 mm.	14	L4	CO2	PO2,3,4 1,2,8
b.	Determine the reinforcement required for a beam of size 300 mm x 600 mm subjected to a factored bending moment of 150 kN-m, factored shear force of 100 kN and factored torsional moment of 50 kN-m. Use M20 concrete and Fe415 steel. Sketch the reinforcement details.	18	L4	CO2	PO2,3,4,6 ,8,12
	UNIT - III	**18**			
3 a.	Design a cantilever beam projecting from column. The clear projection is 1.5 m carries a characteristic live load of 25 kN/m. Use M20 concrete and Fe415 steel. Apply necessary checks and sketch the reinforcement details. Consider width of column = 230 mm.	18	L4	CO2	PO2,3,4,8 ,9,12
b.	Design an intermediate T-beam of effective span 5 m simply supported supporting slab of 125 mm thick. The ribs below the slab are 230 mm wide and 300 mm deep. The slab and beam cast as act together. Determine the reinforcement for the T-beam to carry an imposed load of 5 kN/m^2 and floor finish of 1.5 kN/m^2. Use M20 concrete and Fe415 steel. The beams are spaced at 3.5 m centre to centre. Apply necessary checks and sketch reinforcement details.	18	L4	CO2	PO2,3,4,6 ,7,8,9,12
	UNIT - IV	**18**			
4 a.	Design a simply supported slab of clear size 3.5 m x 8.0 m to carry live load 3 kN/m^2 and floor finish 0.75 kN/m^2. Width of supporting wall = 230 mm. Use M20 concrete and Fe415 steel. Apply necessary checks. Sketch the reinforcement details.	18	L4	CO3	PO2,3,4, 9,12

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b.	Design a dog legged stair case for building in a room measuring 3.0 m x 6.0 m (clear dimensions) Floor to floor height is 3.5 m. Stairs are supported on brick walls 230 mm thick at the end of landings. Use M20 concrete and Fe 415 steel. Consider live load = 5.0 kN/m^2, riser =150 mm and tread = 300 mm. Sketch the reinforcement details.	18	L4	CO3	PO2,3,4,6 ,7,8,9,12
	UNIT - V	**18**			
5 a.	i) Differentiate between long and short columns.	4	L1	CO4	PO2,3
	ii) Design rectangular column of 4.6 m long restrained in position and direction at both ends to carry an axial load of 1500 kN. Use M20 concrete and Fe 415 steel. Sketch the reinforcement details.	14	L1	CO4	PO2,3
b.	Design a square footing of uniform thickness for an axial loaded column of size 450 mm x 450 mm. The safe bearing capacity of soil is 190 kN/m^2, load on column is 850 kN. Use M20 concrete and Fe 415 steel. Sketch the reinforcement details.	18	L4	CO4	PO2,3,4,6 ,7,8,9,12

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